Preliminary comparison of tropical upper troposphere cirrus fraction between OMPS-LP, CALIOP, MLS, AIRS and MODIS 1.38µm

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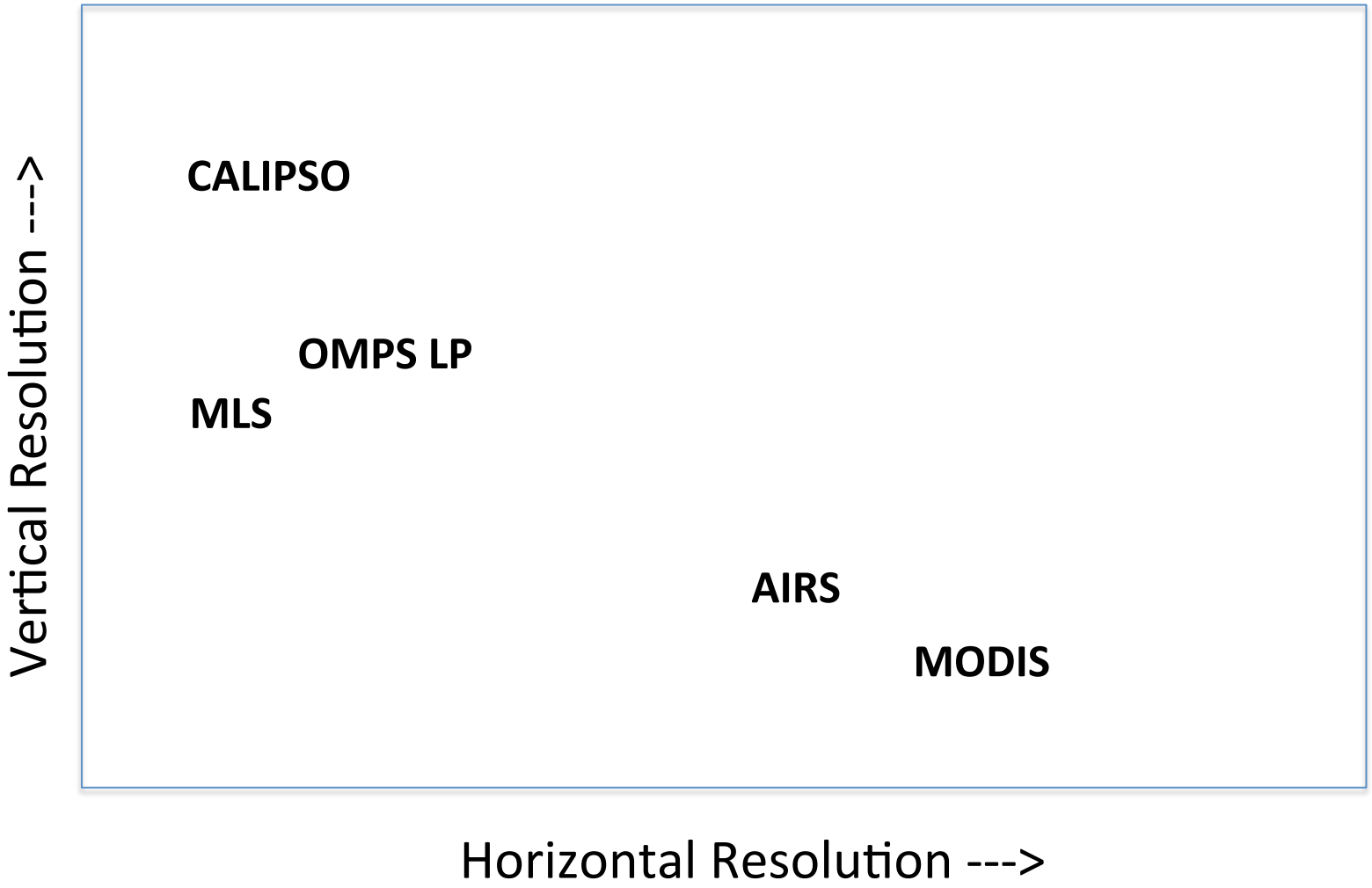
Why do we care?

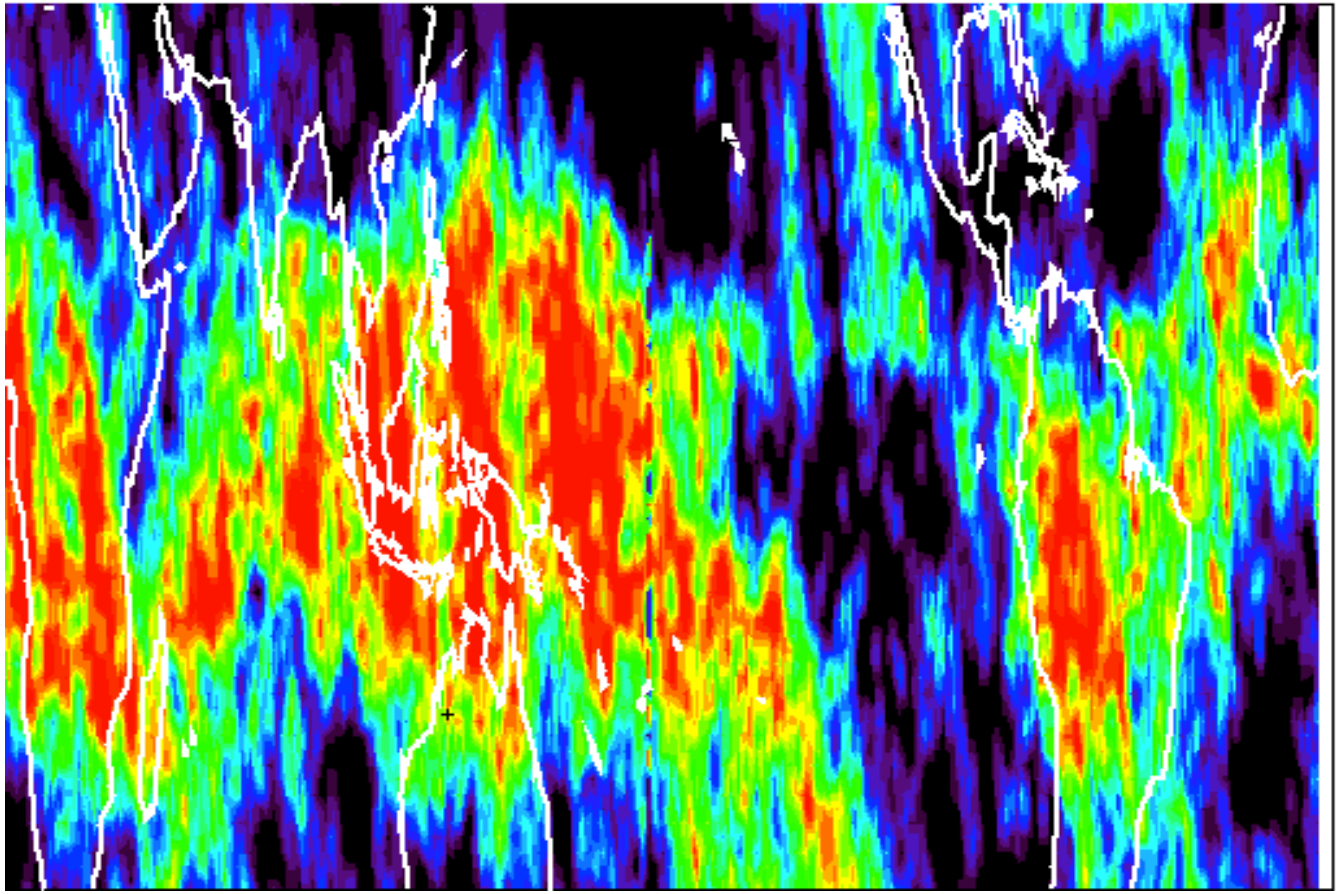
- Cirrus fraction (CF) is of scientific interest
  - Cirrus is a greenhouse cloud
  - Cirrus fraction is predicted to change in response to warming
  - Cirrus fraction is a good model diagnostic
  - Cirrus fraction tells about physical processes associated with cloud nucleation
- Different CF products tell us different things
  - How does cirrus fraction vary with height?
  - How do “total” high cloud fraction products (MODIS, AIRS) compare with vertically resolved CF: OMPS, CALIOPSO, MLS

CF Resolution Comparison

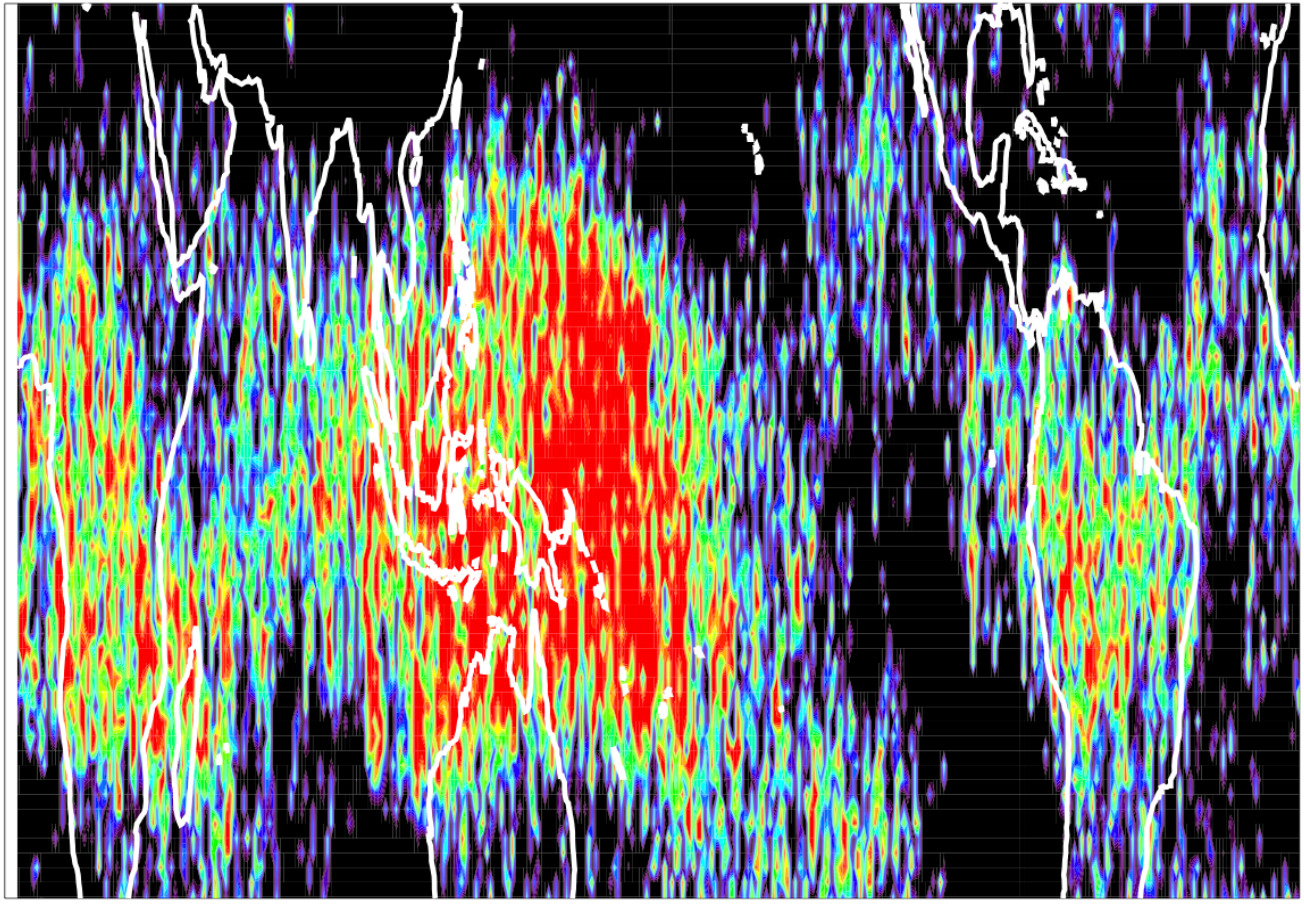


OMPS-LP CF > 12 km

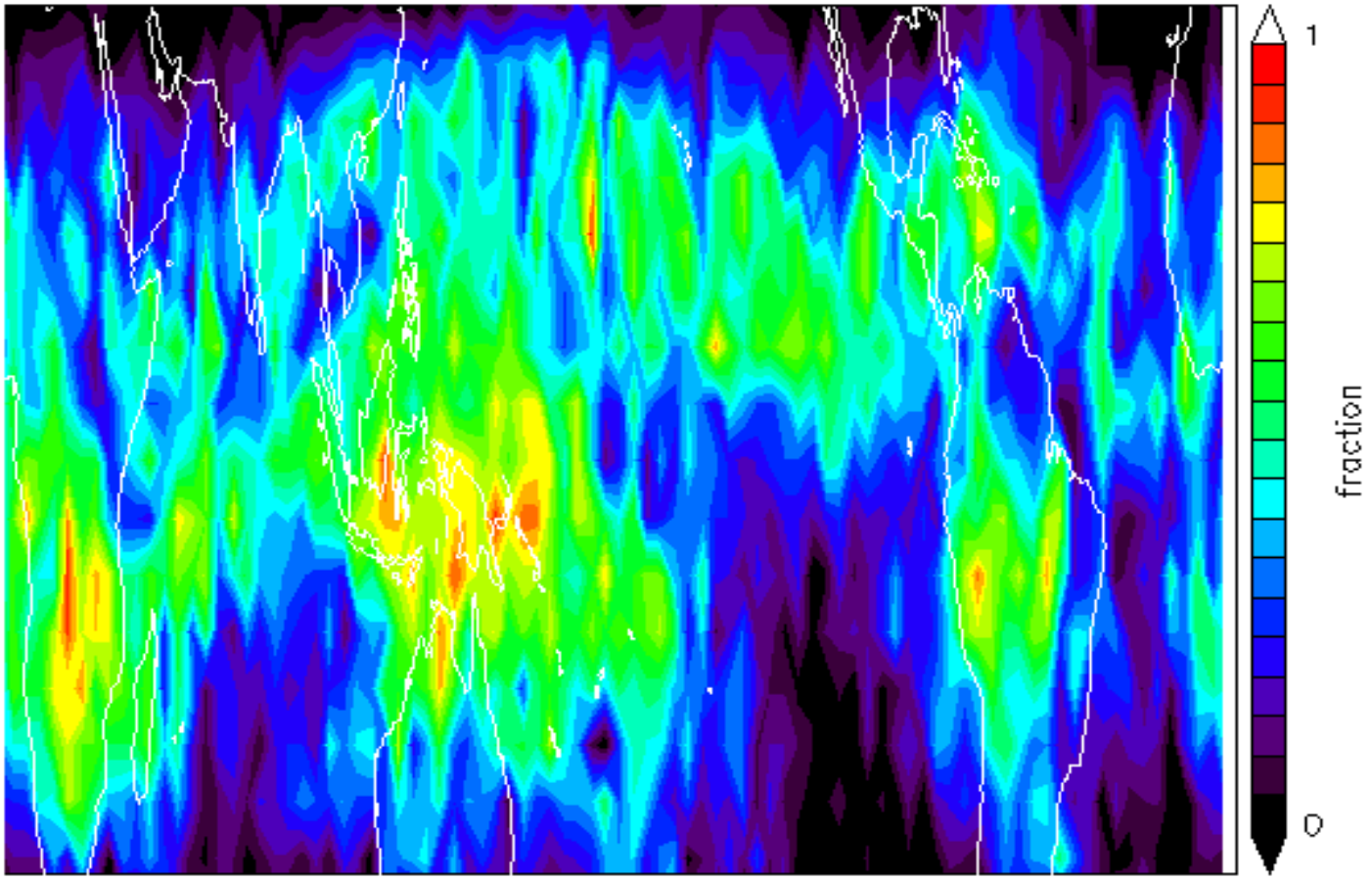
January 2014



CALIOP Cloud Fraction (Z > 12 km)

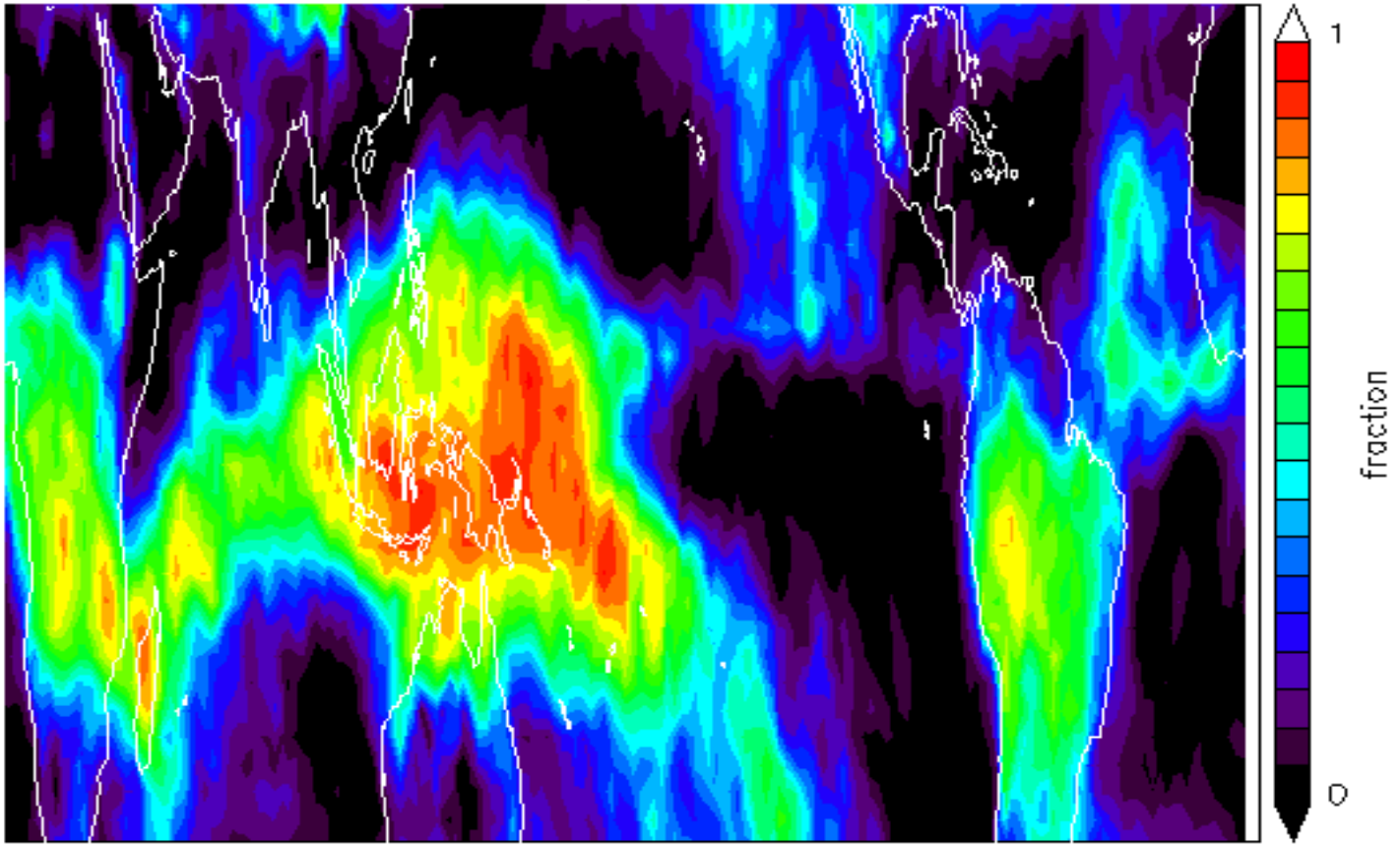


Integrated MLS ice product > 12 km



MLS has lower sensitivity to small ice particles

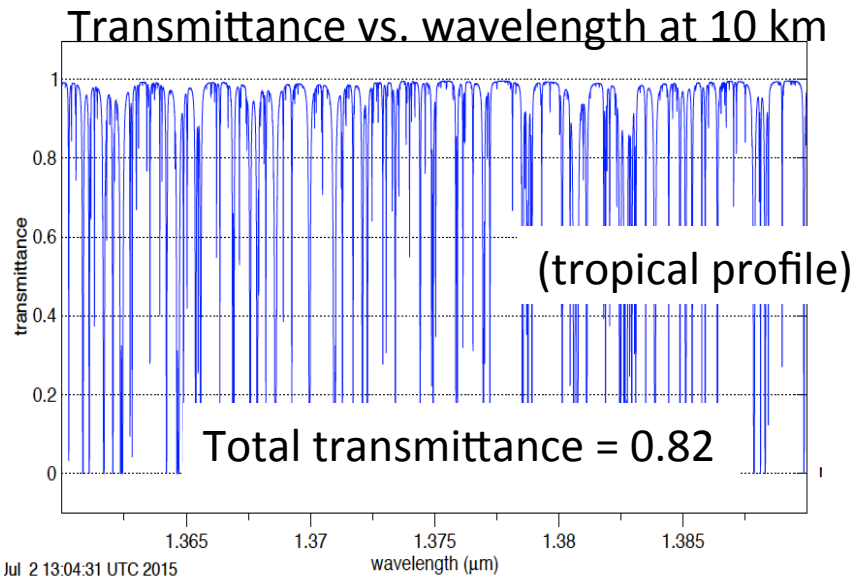
AIRS Cirrus Fraction

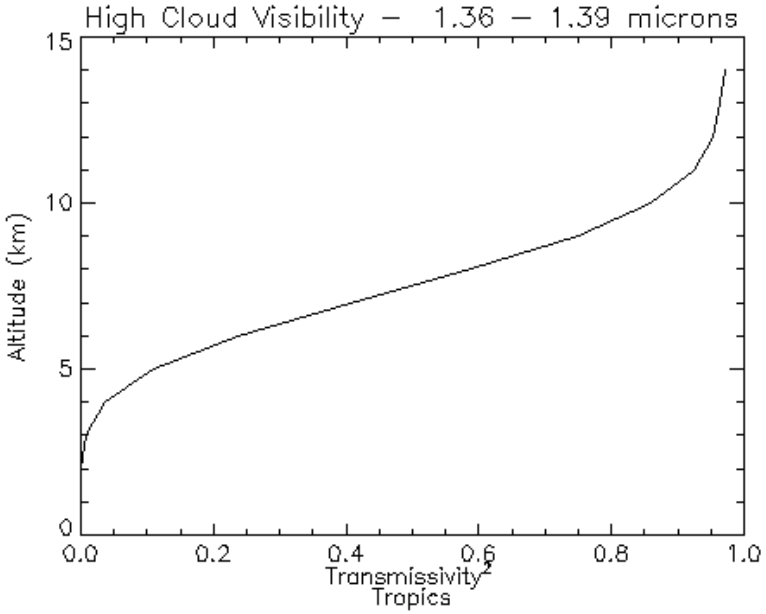


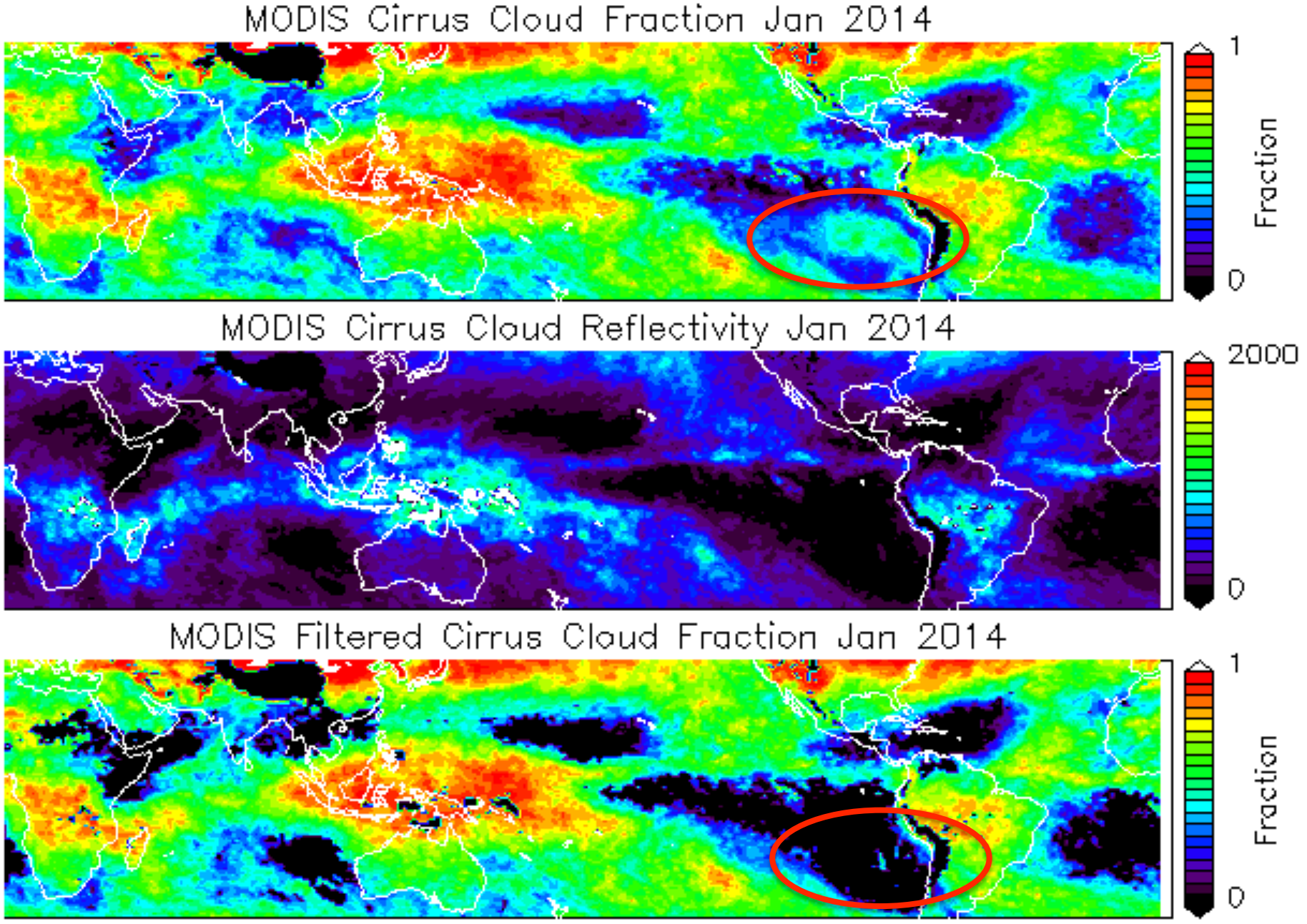
See Brian Kahn publications

MODIS 1.38 µm band

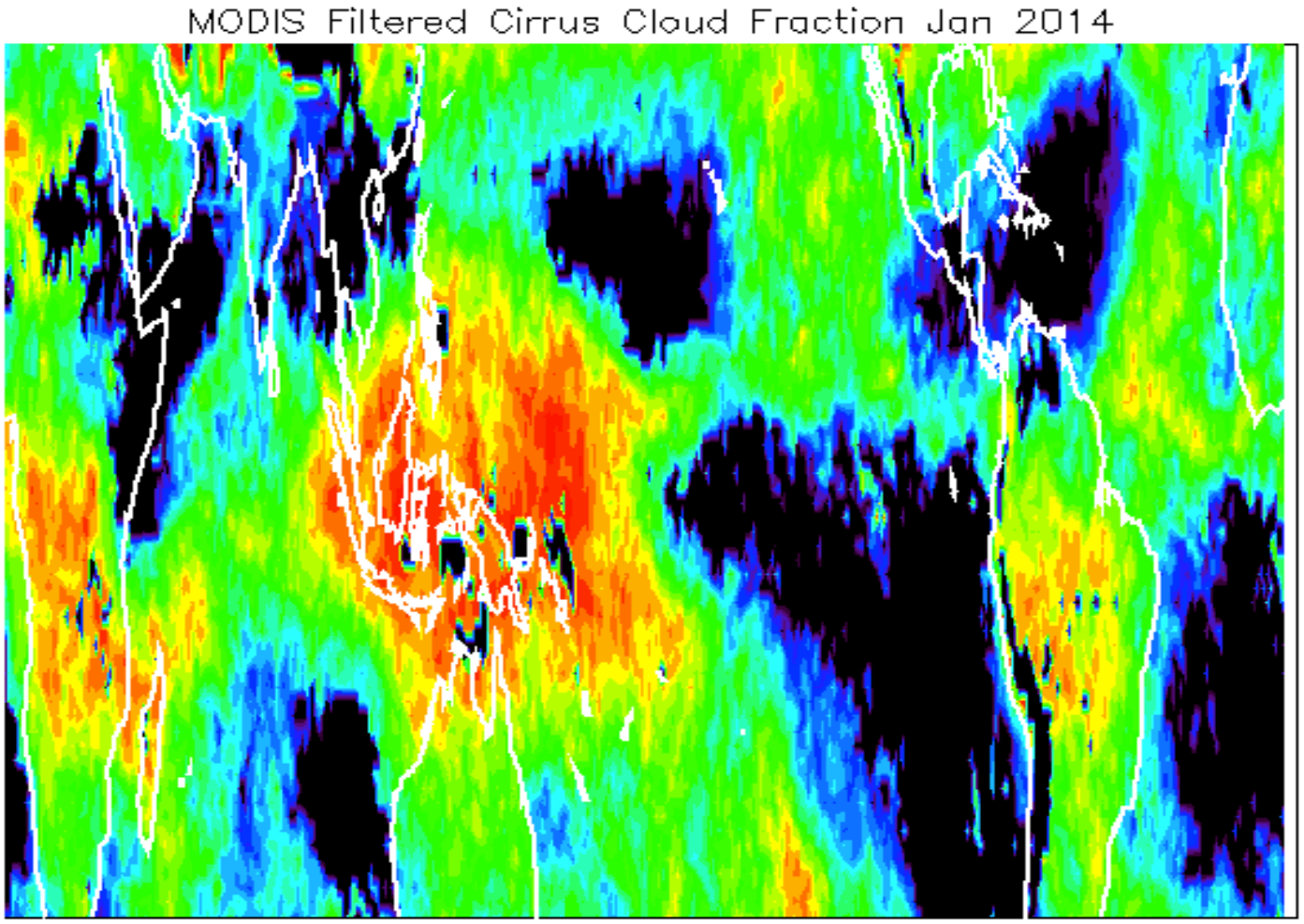
- Originally proposed to identify cirrus interference with other nadir products like ocean color – Ackerman et al.
- 1.38µm is in the middle of strong water vapor absorption bands
- However, the absorption is often not strong enough to block cloud reflectivity from lower altitudes.



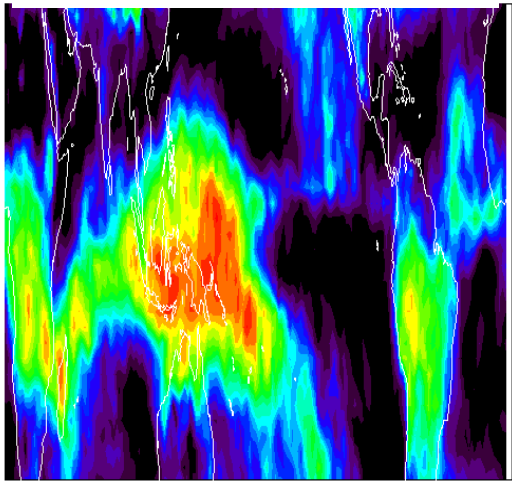



MODIS Cirrus Cloud Fraction Jan 2014
1
Fraction
0
MODIS Cirrus Cloud Reflectivity Jan 2014
2000
0
MODIS Filtered Cirrus Cloud Fraction Jan 2014
1
Fraction
0

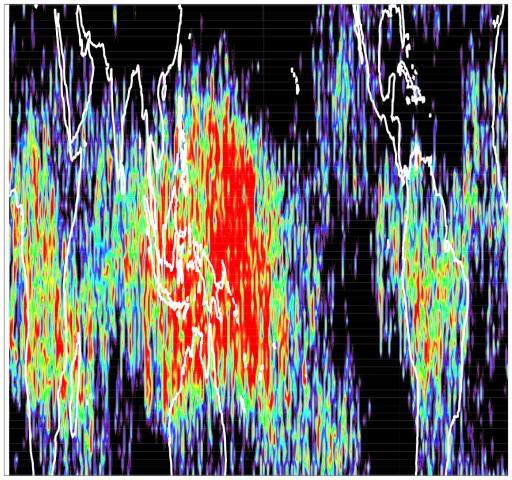
MODIS Cloud Fraction (1.36µm)



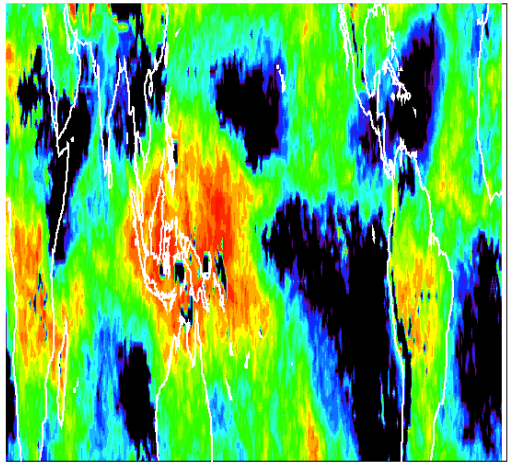
AIRS



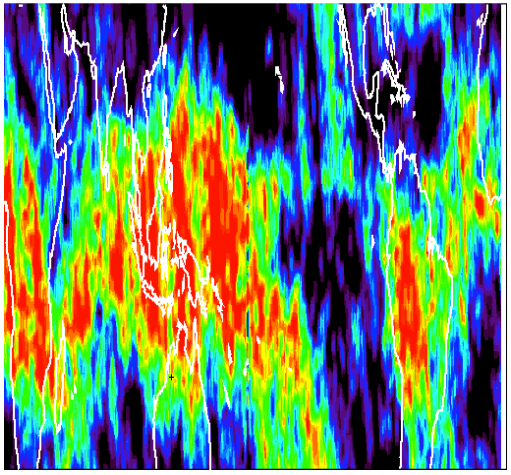
CALIOP Z>12



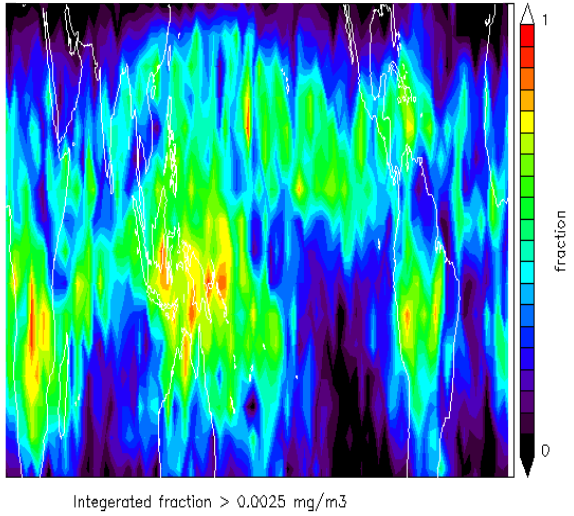
MODIS



OMPS-LP Z>12



MLS Z>12



Common Features

- Southern East Pacific cloud free region
- West Australia cloud free region
- ITCZ
- Lots of clouds over TWP
- Lots of clouds over SA & Africa

NITS

- MLS – too many clouds north of Pacific ITCZ
- MODIS seeing clouds too deep?? (South of Australia)
- AIRS missing ITCZ

Correlation Between Tropical Data Sets, January 2014

OMPS LP and CALIOP = 0.6

OMPS LP and AIRS = 0.78

OMPS LP and MLS = 0.53

OMPS LP and MODIS =0.67

AIRS and MODIS = 0.82

MLS and AIRS = 0.63

Summary

- Reasonable agreement between the various high cloud data sets – but correlations aren't perfect.
- Disagreements should tell us how to adjust the sensitivity of the OMPS-LP cloud algorithm radiance ratio trigger.
- More work to be done ….

Thanks to Matt Deland, Zhong Chen for OMPS-LP data